TITLE OF THE INVENTION

SCREEN OBJECT APPEARANCE CONTROL AND CHANGING METHOD

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a data display device that displays data in a specific representation type on a screen, and , more particularly, to a data display device that makes different types of data more visible even if their representation types are the same.

2. Description of the Related Art

[0002] Data display devices, which display data that can be represented in a specific representation type on a screen, have been used (for example, see Japanese Patent Application Laid-Open No. 2000-020049). More specifically, such conventional data display devices display a collection of digital values in a representation type such as fill, plot, line contour, or vector.

[0003] However, in the conventional data display devices, when different types of data are represented in the same representation type, one type of the data overlaps with or covers the other pieces. As a result, the data tends to appear indistinct due to opaqueness of the overlapped or covered portion.

SUMMARY OF THE INVENTION

[0004] It is an object of the present invention to at least solve the problems in the conventional technology.

[0005] An object display device according to one aspect of the present invention includes an appearance property obtaining unit and a display control unit. The appearance property obtaining unit obtains appearance property of each of object sets that are represented in a same data representation type on a screen. The object set is data objects indicating a type of data, and the appearance property indicates a fill area, the number of colors, or the number of data objects. The display control unit changes an appearance of at least one of the object sets so that the at least one of the object sets is displayed in a distinct appearance, based on the appearance property.

[0006] An object display method according to another aspect of the present invention includes obtaining appearance property of each of object sets that are represented in a same data representation type on a screen. The object set is data objects indicating a type of data, and the appearance property indicates a fill area, the number of colors, or the number of data objects. The object display method also includes changing an appearance of at least one of the objects sets so that the at least one of the object sets is displayed in a distinct appearance, based on the appearance property.

[0007] The computer program product according to still another aspect of the present invention realizes the method according to the present invention on a computer.

[0008] The other objects, features and advantages of the present invention are specifically set forth in or will become apparent from the following detailed descriptions of the invention when read in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] Fig. 1 is a block diagram of a data display device according to a first embodiment of the present invention;

[0010] Fig. 2 is a drawing that explains a display control process;

[0011] Fig. 3 is a flow chart showing the process steps of the data display device according to the first embodiment;

[0012] Fig. 4 shows a weather map output from the data display device;

[0013] Fig. 5 is a drawing illustrating the structure of a computer system according to a second embodiment of the present invention; and

[0014] Fig. 6 is a block diagram of the main unit of the computer system shown in Fig. 5.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0015] Exemplary embodiments of a data display device, a data display method, and a computer program product according to the present invention will be explained next with reference to the accompanying drawings.

[0016] A data display device and a data display method of a first embodiment will be explained first, and then a computer system that executes a computer program product for displaying data according to a second embodiment will be explained. Finally, various modifications of the present invention will be explained.

[0017] An overview and main features of the data display device according to the first embodiment will be explained first. Fig. 1 is a block diagram of the data display device according to the first embodiment of the present invention. The data display device 10 displays data in a specific representation type on a screen.

[0018] The data display 10 is characterized in a data display process that includes obtaining an appearance property of data objects indicating different types of data to be displayed in the same representation type; and changing appearances of the data objects according to the appearance property so that the different types of data are distinctly distinguished from each other. As a result, this data display process allows the data objects to be distinctly visualized even if the data objects indicating the different type of data are represented in the same representation type on a screen.

[0019] For example, if there are data X represented in filled objects Xf and data Y represented in filled objects Yf, where the filled objects corresponding to the specific representation type, the appearance properties of the filled objects Xf and Yf are the fill area and the number of color, If the filled objects Xf are larger than the filled objects Yf in fill area and are smaller than the filled objects Yf in the number of colors, the filled objects Xf and Yf are applied with weighted values so that the filled objects Xf are placed under the filled objects Yf and the filled objects Yf have a transparency smaller than that of the filled objects Xf. The data objects indicating a type of data (corresponding to the filled objects Xf or Yf) will be referred to as "object set" below.

[0020] Thus, the data display device prevents different object sets on a screen from being indistinct due to opaqueness of the overlapped or covered portion of the object sets, and therefore allows the object sets to be distinctly visualized even if the different object sets are represented on the screen in the same representation type.

[0021] The structure of the data display device 10 according to the first embodiment will be explained next. As shown in Fig. 1, the data display device 10 includes an input unit 11, an output unit 12, a memory 13, and a controller 14.

[0022] The input unit 11 receives various data. The input unit 11 can be a keyboard, mouse or a track ball. More specifically, the input unit 11 receives data (which consists of collection of digital values) which can be displayed on the screen, and instructions for a data representation type (e.g. fill, plot, line contour, or vector) in which the data is represented as the object set on the screen. The input unit 11 in the present invention also receives the data for each data representation type.

[0023] The output unit 12 outputs various data. More specifically, the output unit 12 is a display unit which displays the result of the processes carried out by an appearance property obtaining unit 14a, a weighting unit 14b, and a display control unit 14c, which are included in the controller 14.

[0024] The memory 13 is a storage unit which stores data and programs necessary for the processes of the controller 14. More specifically, the memory 13 stores physical data containing the digital values to be handled and a visualizing software program that realizes the data display ways.

[0025] The controller 14 may store control programs (e.g. the operating system), programs for regulating various processes, and the required data. With the help of these programs and data, the controller 14 carries out various processes. Particularly, in the context of the present invention, the controller 14 includes the appearance property obtaining unit 14a, the weighting unit 14b, and the display control unit 14c.

[0026] The appearance property obtaining unit 14a obtains the appearance properties of the object set represented in the same representation type. For instance, as shown in Fig. 2, for data object A and data object B which are represented in the data representation type "fill", the appearance property obtaining unit 14a obtains the appearance properties "the fill area and number of colors" from the memory 13. For data object C and data object D which are represented in the data representation type "plot", the appearance property obtaining unit 14a obtains the appearance property "the number of plots" from the memory 13. For data object E and data object F which are represented in the data representation type" line contour", the appearance property obtaining unit 14a obtains the appearance property "the number of lines from the memory 13. For data object G and data object H which are represented in the data representation type "vector" as well, the appearance property obtaining unit 14a obtains the appearance property "the number of lines" from the memory 13.

[0027] The weighting unit 14b applies a weighted value, to each object set based on the appearance property obtained by the appearance property obtaining unit 14a . More specifically, the weighted values are applied to the objects sets as follows:

FILL: When there are plural fill layers, a transparency is applied as follows:

a weighted value of 0.0 (100% transparency) to 1.0 (0% transparency)

the highest fill area and number of colors: 1/1 = 1.0

the second highest fill area and number of colors:1/2= 0.5

...

the nth hightest fill area and number of colors: 1/n = 0. ### (approaching 0)

PLOT:

the largest number of plots: this number/(a total of all number of plots on n objects sets)

the second largest number of plots: this number/(a total of all number of plots of n objects sets)

...

the nth largest number of plots: this number/(a total of all number of plots on n object sets)

LINE CONTOUR:

the largest number of line contours: this number/(a total of all number/(a total of all number of line contours of n object sets)

the second largest number of line contours: this number/(a total of all number of line contours of n objects sets)

...

the nth largest number of line contours: this number/(a total of all number of line contours of n objects sets)

VECTOR:

the largest number of vectors: this number/(a total of all number of vectors of n object sets)

the second largest number of vectors: this number/(a total of all number of vectors of n objects sets)

...

the nth largest number of vectors: this number/(a total of all number of vectors of n object sets)

[0028] In other words, the weighting unit 14b applies a weighted value to each of data object A and object data B (object sets represented in the data representation type "fill") so that the object set having a larger fill area and fewer colors is placed in a lower layer. The weighting unit 14b applies a weighted value to each of data object C and data object D (the object sets represented in the data representation type "plot") so that the object set having a larger number of plots is placed in a lower layer. The weighting unit 14b applies a weighted value to each of data object E and data object F (the object sets represented in the data representation type "line contour") so that the object set having a larger number of lines is placed in a lower layer. Similarly, the weighting unit 14b applies a weighted value to each of data object G and data object H (the object sets represented in the data "vector") so that the object set having a larger number of lines is placed in a lower layer.

[0029] The display control unit 14c changes the appearance of each object set so that the object set is displayed in a distinct appearance, according to its appearance property obtained by the appearance property obtaining unit 14a. More specifically, as shown in Fig. 2, the display control unit 14c displays the object sets in distinct appearances, according to the weighted values.

[0030] In the case of data object A and data object B (the object sets represented in the data representation type "fill"), for instance, the display control unit 14c superposes data object B on data object A and differentiates the appearances of data object A and data object B by setting

the transparency of data object B to 0.5 (that is, lowers the weighted value that represents the transparency, and increases the transparency). In the case of data object C and data object D (the object sets represented in the data representation type "plot"), the display control unit 14c superposes data object D on data object C and differentiates the appearances of data object C and data object D by making the plot display of data object C black and small and that of data object D large and light in color. In the case of data object E and data object F (the object sets represented in the data representation type "line contour"), the display control unit 14c superposes data object F on data object E and differentiates the appearances of data object E and data object F by showing the lines of data object E as thin lines and those of data object F as thick lines. Similarly, in the case of data object G and data object H (object sets represented in the data representation type "vector"), the display control unit 14c superposes data object H on data object G, and differentiates the appearances of data object G and data object H by showing the vectors of data object G as thin arrows and those of data object H as thick arrows (see Fig. 2).

[0031] The display control unit 14c then creates a display screen by placing the object set represented in the data representation type "fill" (data object A and data object B) in the lowest layer and superposes on this object set the object set represented in the data representation type "line contour" (data object E and data object F), the object set represented in the data representation type "vector" (data object G and data object H), and the object set represented in the data representation type "plot" (data object C and data object D), in that order (and displays the display screen on the output unit 12 (step S405). Fig. 4 shows a weather map output from the data display device.

The following is a legend for fig. 4

Plot: STAR which represents Automated Metrological Data Acquisition system (AMEDAS) rainfall.

Plot: CIRCLE which represents AMEDAS rainfall in 24 hours after STAR.

Line contour: SOLID LINE which represents land temperature data in a range from 0 to 20 degrees in intervals of 2 degrees.

Line contour: BROKEN LINE which represents atmospheric data in a range from 990 hPa to 1050 hPa in intervals of 3 hPa.

Vector: SMALL ARROW which represents a wind velocity on land in intervals of 2 degrees, where 1 cm = 10 m/s

Vector: LARGE ARROW, which represents wind velocity in intervals of 5 degrees, where

1 cm = 5 m/s

Fill 1: Surface temperature

Fill 2: Relative land temperature

[0032] Fig. 3 is a flow chart illustrating the process steps of the data display method according to the first embodiment. The appearance property obtaining unit 14a obtains from the memory 13, the appearance properties " the fill area and/ the number of colors" for data object A and object B which are resentd by the data display way objects sets represented in the data representation type "fill", the appearance property "the number of plots" for data object C and data object D which are object sets represented in the data representation type "plot", the appearance property "the number of lines" for data E and data F which are objects sets represented in the data representation type "line contour", and again the appearance property "number of lines" for data object G and data object H which are object sets represented in the data representation type "vector" (step S401).

[0033] Once all the appearance properties of the object sets for each data representation type has been obtained ("Yes" at step S402), , the weighing unit 14b applies a weighted value to each of data object A and data object B (the object sets represented in the data representation type"fill") so that the object set having a larger fill area and fewer colors is placed in a lower layer, data object C and data object D (object sets represented in the data representation type "plot") so that the object set having a larger number of plots is placed in a lower layer, data object E and data object F (the object sets represented in the data representation type "line contour") so that the object set having a larger number of lines is placed in a lower layer, and data object G and data object H (the object sets represented in the data representation type "vector") so that the object set having a larger number of lines is placed in a lower layer (step S403).

[0034] Next, as shown in Fig. 2, for data object A and data object B (the object sets represented in the data representation type "fill"), the display control unit 14c superposes data object B on data object A and differentiates the appearances of data object A and data object B by setting the transparency of data object B to 0.5 (that is, lowers the weighted value that represents the transparency, and increases the transparency). For data object C and data object D (the object sets represented in the data representation type "plot"), the display control unit 14c superposes data object D on data object C and differentiates the appearances of data object C and data object D by making the plot display of data object C black and small and that

of data object D large and light in color For data object E and data object F (the object sets represented in the data representation type "line contour"), the display control unit 14c superposes data object F on data object E and differentiates the appearances of data object E and data object F by showing the lines of data object E as thin lines and those of data object F as thick lines. Similarly, for data object G and data object H (the object sets represented in the data representation type "vector"), the display control unit 14c superposes data object H on data object G, and differentiates the appearances of data object G and data object H by showing the vectors of data object G as thin arrows and those of data object H as thick arrows (step S404).

[0035] The display control unit 14c then creates a display screen by placing the object set represented in the data representation type "fill" (data object A and data object B) the in the lowest layer, and superposes on this object set the object set represented in the data representation type "line contour" (data object E and data object F), the object set represented in the data representation type "vector" (data object G and data object H), and the object set represented in the data representation type "plot" (data object C and object D), in that order (see Fig. 4) and displays the display screen on the output unit 12 (step S405).

[0036] Thus in the data display device according to the first embodiment, the appearance properties of the object sets represented in the same representation type are obtained, and each object set is displayed in a distinct appearance based on its appearance property. Therefore, plural object sets are distinctly visualized even if they are represented by in the same representation type.

[0037] The data display device and the data display method explained in the first embodiment can be realized by executing programs pre-installed in a computer system such as a personal computer or a workstation. A computer system that executes programs that perform functions similar to those of the data display device (data display method) explained in the first embodiment will be explained next.

[0038] Fig 5 shows a structure of the computer system according to a second embodiment of the present invention. Fig. 6 is a block diagram of the main unit of the computer system shown in Fig. 5. The computer system 100 according to the second embodiment of the present invention includes a main unit 101, a display 102 that displays data such as images on a display screen 102a in accordance with the instructions from the main unit 101, a keyboard 103 for

inputting data into the computer system 100, and a mouse 104 for pointing to any item on the display screen 102a of the display 102.

[0039] The main unit 101 of the computer system 100 includes, a central processing unit 121, a RAM 122, a ROM 123, a hard disk drive (HDD) 124, a CD-ROM drive 125 that receives a CD-ROM109, a flexible disk (FD) drive 126 that receives an FD 108, an I/O interface 127 that connects the display 102, the keyboard 103, and the mouse 104, and a LAN interface 128 that connects to a local area network or a wide area network (LAN/WAN) 106.

[0040] A modem 105 is connected to the computer system 100 for connecting to a public line 107 such as the Internet. Another computer system (PC) 111, a server 112, and a printer 113 are connected to the computer system 100 via the LAN interface 128 and the LAN/WAN 106.

[0041] The computer system 100 realizes the functions of the data display device (data display method) by reading and executing the programs recorded in a specific recording medium. The recording medium may include a portabletype in the form of FD 108, CD-ROM 109, MO disk, DVD disk, magneto optic disk, IC card, etc., or a 'fixed' type in the form of HDD 124 integral to the computer system 100, RAM 122, ROM 123, etc, or a 'communication medium' in the form of public circuit 107 connected through the modem 105 or LAN/WAN 106 by which the computer system 100 is connected to another computer system 111 and the server 112 and which stores the transmitted program for a short duration.

[0042] In other words, the programs that make the computer realize the data display device and the data display method are stored in the portable medium, fixed medium or communication medium described above in a readable manner, and the computer system 100 executes these programs by reading the programs stored in the recording medium. Apart from the computer system 100, the programs for data display can also be executed by another computer system 111 or the server 112 or jointly by another computer system 111 and the server 112.

[0043] Although the invention has been described with respect to a specific embodiment, the appended claims are not to be thus limited but are to be construed as embodying all modifications and alternative constructions that may occur to one skilled in the art which fairly fall within the basic teaching herein set forth.

[0044] In the present embodiment, weighting of plural object sets represented in the same data representation type is performed based on the appearance property of the object set.

However, the object sets themselves may be applied with a weighted values and the predetermined object set which needs to be accentuated may be highlighted.

[0045] Moreover, all the manual processes explained in the present embodiment can be entirely or in part carried out automatically. The sequence of processes, the sequence of controls, specific names, and data including various parameters (e.g. weighted value) can be altered as required unless otherwise specified.

[0046] The constituent elements of the device illustrated are merely conceptual and may not necessarily physically resemble the structures shown in the drawings. For instance, the data display device need not necessarily have the structure that is illustrated. The device as a whole or in part can be broken down or integrated either functionally or physically in accordance with the load or how the device is to be used.

[0047] The process functions executed by each device may be realized, entirely or in part, by the central processing unit and the programs executed by the CPU, or by hardware through wired logic.

[0048] According to the present invention, the appearance property of each object set represented in the same data representation type is obtained, and each object set is displayed in a distinct appearance based on its appearance property. Consequently, a data display device is obtained in which plural object sets can be distinctly visualized even if they are represented in the same representation type.

[0049] According to the present invention, the appearance property of each object represented in a fill data representation type is obtained, and each object set is displayed in a distinct appearance based on its appearance property. Consequently, a data display device allows the data to be distinctly visualized even if different types of data are represented in the fill data representation type on a screen.

[0050] According to the present invention, the appearance property of each object set represented in a vector data representation type is obtained, and each object set is displayed in a distinct appearance based on its appearance property. Consequently, a data display device allows the data to be distinctly visualized even if different types of data are represented in the vector data representation type on a screen.

[0051] Although the invention has been described with respect to a specific embodiment for a complete and clear disclosure, the appended claims are not to be thus limited but are to be construed as embodying all modifications and alternative constructions that may occur to one skilled in the art which fairly fall within the basic teaching herein set forth.